Masters of Arts in Biology

January 23rd, 2018

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Associate Dean, Office of Graduate & Postdoctoral Studies
Division of Biology & Medicine
Masters of Arts in Biology

• Established in 1993 via contractual agreement.

• Accredited by Connecticut Department of Education.

• Course offering is a section of an existing Brown University course.
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• “The quality of student performance required is at least as rigorous as for the Master of Arts degree within any Graduate Program in the Division.

• The difference is the Pfizer students obtain breadth in Biology in more than one graduate area by not imposing strict requirements for specific courses.”
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Objectives

• Provide graduate instruction within the biological sciences for Pfizer colleagues and contractors who wish to extend their knowledge in discrete areas relating to their employment and/or interests.

• Provide a broad-based and rigorous Master of Arts training in biological sciences.
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Experiences

Over 180 M.A. in Biology awarded.
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Experiences

• Many colleagues have remained with Pfizer with advancement within your organization.

• Others have earned additional master’s or PhD degrees.
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Overview

• Open to Pfizer contractors and colleagues.

• Only one prerequisite required:
  • *A Bachelors degree in any field.*

• All courses held on-site at Pfizer-Groton campus and available via WebEx for offsite employees.
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Overview

- Pfizer employees and contractors register as Special Students via a Registration Form;
  - Standard Brown tuition fees apply.

- Students apply to Graduate School for the M.A. program after successful completion of two courses.

- Pfizer reimburses colleagues only who pass with grade of a ‘B’ or better.

- Students must comply with Academic code and Title IX training (on-line)
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Program Requirements

• 8 graduate courses:
  • 2 of 8 courses in “core” subjects
    • cell biology,
    • biochemistry,
    • genetics,
    • pharmacology;
  • 6 of 8 courses with grade of ‘B’ or better.

• Passing final paper or proposal “culminating experience” on topic approved by Assoc Dean, Graduate & Postdoctoral Studies.
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Program Requirements: Culminating Experience

• As a culminating experience for the Master of Arts in Biology Program, there are two options:
  • an NIH style research proposal based on an original hypothesis or
  • a final paper which, based on the course work taken by the student, represents an original in-depth analysis and literature review of a problem in modern biology.
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Program Requirements: Culminating Experience

• **Research proposal** (written as though you were preparing a NIH RO1 application) will include:
  • project summary/abstract,
  • specific aims,
  • research strategy,
  • literature cited.

• **Final paper** (10-15 pgs, excluding figures and references) will include:
  • introduction,
  • discussion,
  • conclusion,
  • literature cited.
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Program Requirements:
Culminating Experience

• Topics must be discussed with, and approved by the Associate Dean for Graduate and Postdoctoral Studies.

• The final project may be undertaken following completion of 7 courses, but must be completed no later than one semester following completion of the 8th course.
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Program Requirements:
Culminating Experience

• Both projects are designed to demonstrate the student's ability to master and integrate the knowledge gained in the prior course work and to apply that knowledge to a specific problem in modern biology.
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Program Requirements

• No courses can be transferred from another institution.

• Must be actively employed as a colleague or contractor at Pfizer.

• Pfizer M.A. students may take courses toward the degree on Brown University campus with permission of instructor and Assoc. Dean of Graduate and Postdoctoral Studies.
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Program Requirements

• Once accepted by the Graduate School, the students are expected to enroll in courses continuously each semester;
  • with the exception of the summer term.
  • If not, a request for a Leave of Absence (LOA) must be submitted one month prior to the start of the term via the Graduate School to avoid billing.
  • Only one LOA is permissible during the course of study.
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Application Requirements

• Successful completion of two Brown University graduate courses (B or better).

• Undergraduate transcript with date of degree.

• Letter of recommendation from Supervisor at Pfizer.

• 1-2 pg. Colleague Statement

• No GRE requirement!
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Auditing of Classes

• **Auditing.** is a student who is registered in a course without earning academic credit upon successful completion under the following conditions:
  – (1) the student must be properly registered for it;
  – (2) the student is entitled to all instruction in the course, including conferences; but will not receive criticism of papers, tests, and examinations.

• Auditing of courses is available only to Pfizer students who have graduated with the Brown/ Pfizer MA degree.

• All other Pfizer students are required to enroll in the course.
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Auditing of Classes

• Auditing of courses is limited to a total of 2 courses per Brown/ Pfizer MA graduate.

• To audit a BROWN course, the student must receive permission from the instructor prior to the start of the course.
  – The audited course shall be entered on the permanent record of any student electing this privilege.
  – The status of a course in which a student has registered may not be changed from audit to credit at any time.

• Auditing of a course will be at no cost to the student.
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Upcoming Courses

• Fall 2016: Cancer Biology
• Spring 2017: Molecular Genetics
  • Core course
• Fall 2017: Virology
• Spring 2018: The Immune System
• Fall 2018: Advanced Biochemistry
  • Core course
• Spring 2018: Biotechnology and Global Health
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Previous Courses

• Advanced Biochemistry,
• Advanced Microbiology,
• Cancer Biology,
• Cell Biology,
• Developmental Biology,
• Drug Delivery,
• Human Physiology,
• Introduction to Epidemiologic Research Methods
Questions?
The Immune System

Rick Bungiro, Ph.D.
Senior Lecturer
Dept. of Molecular Microbiology & Immunology
Richard_Bungiro@Brown.edu
Why Study the Immune System?

• It’s everywhere (and it’s cool)
• To gain a deeper understanding of biological systems
• To understand why we get sick, and also why we usually don’t
• To provide knowledge that allows manipulation of its function to our benefit
  – Vaccines
  – Therapies (allergies, autoimmunity, cancer)
  – Transplantation (organs, stem cells)
  – Biotechnology (e.g. diagnostics)
  – Defense against new pathogens
Pregnancy tests utilize antibodies:

- Non-Steroidal Anti-Inflammatory Drugs (NSAIDS)
- Antihistamines
- Topical Steroids

These products modify an immune response:

Rapid HIV tests detect antibodies:

Non-Steroidal Anti-Inflammatory Drugs (NSAIDS)
Antibody-Based Pharmaceuticals Such As Humira, Remicade and Enbrel Have Provided New Treatment Options to Patients With Chronic Inflammatory Diseases Such As Crohn’s and Rheumatoid Arthritis (But Are Not Without Drawbacks and Risks)

My Crohn’s is much better, but I sure hope none of my friends have tuberculosis!

What is Humira?

Humira is a biological drug whose active substance is called adalimumab, a human monoclonal antibody that is produced from cell cultures. Monoclonal antibodies are proteins that recognise and bind onto other unique proteins. Adalimumab binds to a specific protein called tumour necrosis factor (TNF) that is part of the body’s immune system. In many inflammatory diseases, the body has an excess of TNF and this keeps the disease going and makes it worse. Humira is a drug that has been specifically designed to bind to and block the effect of TNF. This in turn reduces the inflammation in the intestines of a person suffering from Crohn’s disease.

Normally people who suffer from a severe form of Crohn’s disease are given Humira, when other forms of treatment have not helped or have not had sufficient effect. Humira is often given as a single therapy, but during the initial stages you can be given Humira in combination with the drugs you were taking before.
A Conjugate Vaccine for *Streptococcus pneumoniae* Has Greatly Reduced Invasive Pneumococcal Disease in Children

Figure 1. Changes in incidence rate* of invasive pneumococcal disease (IPD) among children aged <5 years before and after introduction of 7-valent pneumococcal conjugate vaccine (PCV7), by age and year — Active Bacterial Core surveillance, eight states,† 1998–2005

* Per 100,000 population.
† California (one county); the state of Connecticut; Georgia (20 counties); Maryland (six counties); Minnesota (seven counties); New York (seven counties); Oregon (three counties); and Tennessee (four counties).

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**Figure 19-5a**

Kuby IMMUNOLOGY, Sixth Edition

© 2007 W. H. Freeman and Company
Course Objectives
(What’s in it for you?)

• Familiarity with the basic elements and function of the mammalian immune system
• Understanding of the theoretical concepts of immunology
• Exposure to the experimental analysis of immunological questions
• Appreciation of the medical and technological applications of the science of immunology
Rick Bungiro
(Your Friendly Instructor)

• Johns Hopkins University, B.A. in Biology 1992
• Brown University, Ph.D. in Pathobiology 1999
• Yale University
  - Postdoctoral Fellow 1999-2004
  - Associate Research Scientist 2004-2008
• Returned to Brown as a Lecturer in 2008
• Currently a Senior Lecturer, teaching:
  BIOL 0530: Principles of Immunology
  BIOL 0510: Introductory Microbiology Lab
  BIOL 1520: Innate Immunity (coinstructor)
  BIOL 1600: Development of Vaccines
  [BIOL 1550: Emerging Microbial Diseases]
Dr. B’s Promises to You

• I welcome you
• I value you
• I will excite you
• I will challenge you
How Grades Are Determined

4 Homeworks 100 points
Midterm Exam 100 points
Final Exam 200 points
Final Paper 100 points
TOTAL 500 points

>425 (85%) points = likely A
>350 (70%) points = likely B
>275 (55%) points = likely Pass
The Immune System

• Has the ability to resist/resolve diseases caused by a great diversity of infectious agents:
  – Viruses -> polio, smallpox, influenza, measles, HIV
  – Bacteria -> tuberculosis, tetanus, pertussis
  – Fungi -> thrush, ringworm
  – Parasites:
    – Protozoan -> malaria, leishmaniasis
    – Helminths (worms) -> tapeworms, flukes, roundworms

• There is compelling evidence that the immune system may also protect against certain types of cancer

• Operates at two basic levels to prevent infection and (when infection occurs) restrict progression to disease & death
  – Innate immunity
  – Adaptive (acquired) immunity
Innate Immunity

• Basic resistance mechanisms that an individual is born with (requires no prior experience)
• Employs anatomical barriers, phagocytic cells, soluble mediators, and inflammatory responses
• **First** line of defense in vertebrates, and the **only** form of defense in other multicellular organisms
• Fixed specificity that broadly recognizes molecular **patterns** shared by various classes of microorganisms
• Acts quickly (minutes to hours)
• Is not adaptive (does not improve with experience)
• Clears most infections, limits many others and generates signals that activate and enhance adaptive immune responses
If so many effective innate mechanisms exist, why do we need anything else?

Infectious organisms are “smart”

- They have much shorter generation times (i.e. rapid replication)
- Their genomes are more “plastic” (changeable) than ours
- Many have evolved ways to circumvent our innate defenses

Our adaptive immune response helps to level the playing field

- The cells that mediate acquired immunity are capable of rapid clonal expansion
- The genes which encode receptors of the adaptive system (antigen recognition molecules; ARMs) are also plastic
- Adaptive responses can counteract many of the evasion strategies that microbes deploy
Eventually, you will understand all of this.

(Really)
Eventually, you will appreciate how much I left out. (Really)
Note that the “secondary” (memory) anti-A response is **specific** to Antigen A.
Immune Dysfunction: When a good system goes bad

• Allergies and Asthma
• Graft rejection and graft-versus-host disease
• Autoimmune disease
• Immunodeficiency (inborn and acquired)
Allergies

- pollen
- house dust mite
- wasp
- drugs
- peanuts
- shellfish

Common Allergens

Hay Fever

Allergic Reaction to Bee Sting
Autoimmune Diseases

The “butterfly” rash of systemic lupus erythematosus

Distorted joints resulting from rheumatoid arthritis
Immunodeficiency

Primary (inborn):
Severe Combined Immunodeficiency (SCID)
Also known as “Bubble boy” disease

Secondary (acquired):
Acquired Immune Deficiency Syndrome (AIDS) caused by HIV infection leads to “opportunistic” infections
Advanced Biochemistry

Professor Gerwald Jogl
Fall 2018
Core Course
Biochemistry:

We will focus on principles, not detailed reactions!
Biochemistry: Protein structure

Figure 6-1
Lehninger Principles of Biochemistry, Seventh Edition
© 2017 W. H. Freeman and Company
Figure 28-14

Lehninger Principles of Biochemistry, Seventh Edition
© 2017 W. H. Freeman and Company

Biochemistry: DNA/RNA binding
Biochemistry: Protein synthesis

Figure 27-34
Lehninger Principles of Biochemistry, Seventh Edition
© 2017 W. H. Freeman and Company
Course Objectives

• The objective of this course is to study how essential concepts of biochemistry are applied in current biomedical research.

• We will review core topics of biochemistry and read recent research publications relevant to these topics.
Typical Class Structure

1/3 – lecture and discussion of fundamental concepts from assigned textbook reading.

1/3 – discussion of concepts and experimental approach of assigned publications

1/3 – discussion of assigned reading

The in-class discussion will
(a) examine the experimental approach,
(b) how the results of each report fit with prior knowledge, and
(c) how these findings moved the field forward.
Course Syllabus:

1. Foundations of Biochemistry
2. Proteins
3. Carbohydrates and lipids
4. Enzyme function
5. Glycolysis and citric acid cycle
6. Exam 1
7. Oxidative phosphorylation
8. Amino acids and nucleotides
9. Integration of metabolism
10. Nucleic acids, DNA, RNA
11. Replication and transcription
12. Protein synthesis
13. Exam 2
Course Reading

Textbook
Biochemistry
First Edition 2017
Miesfeld & McEvoy, Norton

Two recent research publications for each
Example: Protein Synthesis
Shi, Kotaro et al.
*Heterogeneous ribosomes preferentially translate distinct subpools of mRNAs genome-wide.*
Molecular Cell (2017)

Florin, Maracci et al.
*An antimicrobial peptide that inhibits translation by trapping release factors on the ribosome.*
Nature Structural and Molecular Biology (2017)
Biotechnology & Global Health

Toni-Marie Achilli, PhD
Lecturer in MPPB
Spring 2019
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*How to get started???

1. Register for course offering via the Brown website:
   
   http://www.brown.edu/pfizer

2. Educational Assistance:
   
   – Colleagues: Apply for via HR source. Following the successful completion of the course (‘B’ or better), you will be reimbursed by Pfizer to pay off your loan.

   – Contractors: None available, but Ledge Light credit union has individual educational loan options.
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How to get started???

3. Mail tuition check to:

Brown University Cashier's Office
164 Angell Street
Box 1911
Providence, RI 02912
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Pfizer Contact

• Katelyn Stachelek
  – Pfizer Global R&D; Groton Labs
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• **Good luck!!**